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This text seems to be an improvement over the author's earlier edition, both in attractiveness of the printed page and abundance of well-selected original exercises. After all the pupil's ability to solve original theorems is the real test of geometrical knowledge.

The text as a whole seems to meet very well the recent demands for the subject.

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F. W. GATES.

## PROBLEMS AND SOLUTIONS.

EDITED BY B. F. FINKEL AND R. P. BAKER.

### PROBLEMS FOR SOLUTION.

#### ALGEBRA.

**441. Proposed by W. D. CAIRNS, Oberlin College.**

Prove that the equation  $(e - 1)x = e^x - 1$  has two and only two real roots. [Adapted from *L'Intermédiaire*.]

**442. Proposed by CLIFFORD N. MILLS, Brookings, North Dakota.**

Show that the sum of  $n$  terms of the series  $1/2 - 1/3 + 1/4 - 1/6 + 1/8 - 1/12 + \dots$  is  $1/3[1 - (1/2)^{n/2}]$  when  $n$  is even, and  $1/3[1 + 2\sqrt{2}(1/2)^{(n/2)+1}]$  when  $n$  is odd.

#### GEOMETRY.

**472. Proposed by PAUL CAPRON, U. S. Naval Academy.**

The sides of a spherical triangle are  $a, b, c$ ; the corresponding opposite angles are  $A, B, C$ ;  $p$  and  $P$  are the polar distances of the inscribed and circumscribed circles;  $a + b + c = 2s$ ;  $A + B + C = 2S$ . From a geometric figure, by the formula for solving right spherical triangles, show that

$$(1) \quad \tan^2 p = \operatorname{cosec} s \sin(s - a) \sin(s - b) \sin(s - c);$$

$$(2) \quad \cot^2 P = -\sec S \cos(S - A) \cos(S - B) \cos(S - C).$$

Thus establish the usual formulas for the tangent of the half-sides and half-angles.

Also show that

$$(3) \quad \frac{\text{sine of angle}}{\text{sine of the opposite side}} = \frac{\cot P \cos S}{\tan p \sin s}.$$

**473. Proposed by FRANK R. MORRIS, Gendale, Calif.**

What is the length of the longest rectangle an inch wide that can be placed inside another rectangle 12 inches long and 8 inches wide. Obtain the result correct to the third decimal.

#### CALCULUS.

**393. Proposed by LAENAS G. WELD, Pullman, Ill.**

Find the area of the least ellipse which can be drawn upon the face of a brick wall so as to inclose four bricks.

**394. Proposed by W. W. BURTON, Macon, Ga.**

A horse runs 10 miles per hour on a circular race-track in the center of which is an arc-light. How fast will his shadow move along a straight board fence (tangent to the track at the starting point) when he has completed one eighth of the circuit?